3.4

Properties of logarithmic Funct.

Let b, R, S, be positive real #'s, $b \neq 1$, c any real #

*Product Rule: $\log_b(RS) = \log_b R + \log_b S$

Quotient Rule: $\log_b \frac{R}{S} =$

$\log_b R - \log_b S$

Power Rule: $\log_b R^c =$

$c \log_b R$

Ex. Expanding log of a product & quotient

1) $\log(4x^2y^3) =$

$\log 4 + \log x^2 + \log y^3 =$

$\log 4 + 2\log x + 3\log y$

2) $$\ln \frac{\sqrt{x^2+7}}{x} = \ln \frac{(x^2+7)^{1/2}}{x} =$$

$$\ln (x^2+7)^{1/2} - \ln x =$$

$$\frac{1}{2} \ln (x^2+7) - \ln x$$

Condensing a log:

write $\log y^4 - 7\log(yz)$ as a single logarithm.

$$\log y^4 - \log(yz)^7 = \log \frac{y^4}{(yz)^7} =$$

$$\log \frac{1}{y^3 z^7}$$

Change of base:

$\log_4 7 = ? \rightarrow \log_4 7 = y$

Changing to exp. form

$4^y = 7$ (take ln of both sides)

$\ln 4^y = \ln 7$

$y \ln 4 = \ln 7 \rightarrow y = \frac{\ln 7}{\ln 4}$

So, Change of base formula:

a, b, x positive real #'s

$a \neq 1, \quad b \neq 1.$

$$* \log_b x = \frac{\log_a x}{\log_a b}$$

Ex. Evaluate

1) $\log_3 16 = \dfrac{\ln 16}{\ln 3} \approx 2.523\ldots$

2) $\log_6 10 = \dfrac{\log 10}{\log 6} = \dfrac{1}{\log 6} \approx 1.285\ldots$

More examples:

Express as sum or difference

1) $\log 27x = \log 3^3 x =$

$3\log 3 + \log x$

2) $\log 100y^3 = \log 10^2 y^3 =$

$2\log 10 + 3\log y =$

$2 + 3\log y$